Nose-to-Brain drug delivery for neurological disorders: classification of nasal anatomy for personalised medicine

Co-promotor: Benoît HAUT

Advisor: Clément RIGAUT

Lab: TIPs

Description:

Context: Personalized medicine is an ensemble of techniques aiming to adapt medical treatments to each patient. For example, in the context of nose-to-brain delivery (i.e. administrating neurological drugs via the nose), personalised medicine could improve the outcome of the treatment. Indeed, the drug has to reach a precise region of the nose, the olfactory area, to be effective. But accessing this zone is challenging and requires strategies adapted to the patient's nasal anatomy.

Objective: This thesis aims to classify the anatomies of the patients into families. To this end, the results of spray deposition in nasal replicas, Computational Fluid Dynamics simulations and other measurements based directly on the CT scan can be exploited. The goal is to be able to advise appropriate procedures and administration for each patient with minimal measurements.

Methods: First, the appropriation data reduction and clustering methods will be used to give a first idea of the parameters influencing drug deposition in the cavities. Then, a predictive model will be developed and tested to generalise the findings. Finally, general recommendations will be drawn to guide health practioners to choose the best approach for each case.

Prerequisites:

- Multivariate statistics
- Knowledge of a programming language

Contact: Clément Rigaut (clement.rigaut@ulb.be)

References:

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[1] W. Keustermans, T. Huysmans, B. Schmelzer, J. Sijbers, and J. JJ. Dirckx, 'The effect of nasal shape on the thermal conditioning of inhaled air: Using clinical tomographic data to build a large-scale statistical shape model', Computers in Biology and Medicine, vol. 117, p. 103600, Feb. 2020, doi: 10.1016/j.compbiomed.2020.103600.